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current Marine Corps campaign plans that provide the operational direction and focus necessary to meet Marine Corps long term contingency requirements and obligations. These plans provide the baseline for establishing assumptions from which to validate future MAGTF and MACCS concepts. From this study the reader will be provided the basis to formulate the future role of a responsive and survivable MACCS in support of the unique challenges the MAGTF will encounter in the spectrum of low intensity conflict entering the twenty-first century.

USAWC MILITARY STUDIES PROGRAM PAPER

MARINE AIR COMMAND AND CONTROL SYSTEMS: PAST, PRESENT, AND FUTURE ROLE IN SUPPORT OF MARINE AIR-GROUND TASK FORCE OPERATIONS IN LOW INTENSITY CONFLICT

An Individual Study Project
Intended for Publication

by

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ABSTRACT

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This study will provide the reader with a historical overview of the Marine Air Command and Control Systems (MACCS) and its associated air control agencies and weapons systems. It will trace the evolution of the MACCS operational and organizational concepts, to include mission, functions, roles, capabilities, and structure that are essential to the Marine Air-Ground Task Force (MAGTF) commander for planning, coordinating, and controlling his forces pursuant to the use of combat power. The study will draw on current Marine Corps campaign plans that provide the operational direction and focus necessary to meet Marine Corps long term contingency requirements and obligations. These plans provide the baseline for establishing assumptions from which to validate future MAGTF and MACCS concepts. From this study the reader will be provided the basis to formulate the future role of a responsive and survivable MACCS in support of the unique challenges the MAGTF will encounter in the spectrum of low intensity conflict entering the twenty-first century.

INTRODUCTION

In July 1989, General A. M. Gray, the Commandant of the Marine Corps, seeking to improve the warfighting capabilities of the Marine Corps and to provide a better understanding of requirements for each Marine, approved three significant documents. First, and perhaps the most important, was the Marine Air-Ground Task Force (MAGTF) Master Plan. It "addresses the full range of concepts necessary to organize, man, equip, train, deploy, employ, and sustain MAGTF's through the year 2000."[1] In addition, it examines the Marine Corps roles and missions, capabilities, structure and posture, and how it will train and employ as part of the "balanced fleet." The second document, the Marine Corps Campaign Plan (MCCP), characterized as the "umbrella document" for planning within the Marine Corps, describes "actions which will focus plans, policies and studies programs to meet the Marine Corps long term and contingency requirements and obligations."[2] It also outlines "common direction to Fleet Marine Force (FMF) commands and supporting agencies."[3] Third, is the Marine Corps Long-Range Plan (MCLRP) which is derived from the MCCP and is designed to be a forward looking (working) document for Marine Corps planners. It defines the future goals of the Marine Corps which will "guide the development of doctrine, training, force structure, and material"[4] from 2005 through the year 2010.

These plans have for the first time provided the Marine Corps with a solid foundation to span an ever widening gap between the planning and programing process associated with MAGTF capabilities and deficiences. The MAGTF Master Plan (MMP) provides direction for further development of subordinate plans which will cover in more detail areas of command, ground combat, aviation combat, and combat service support. Additionally, these actions pave the way for an introspective examination of the MAGTF roles and missions (functions), force structure, and doctrine fundamental to the strategic direction the Marine Corps must focus on entering the twenty-first century and beyond. This process will require continual assessment and evaluation of operational and organizational concepts if the Marine Corps is to continue to provide the National Command Authority (NCA) the greatest strategic asset that a sea-based power can possess--an amphibious force.

LOW INTENSITY CONFLICT

For purposes of this study, the aforementioned plans (MMP, MLRP, and MCP) and the Marine Air Command and Control Systems (MACCS) Operational Concept 2000 (FMFRP 14-5), will serve as baseline sources to examine the capabilities and employment of the MACCS to support prosecution of MAGTF operations that a Marine Expeditionary Force (MEF) might engage in during the twenty-first century in the spectrum of low intensity conflict (LIC).

Current emphasis in LIC, as outlined in a 1987 classsified

Presidential directive, U.S. Capabilities to Engage in Low-Intensity Conflict and Conduct Special Operations, will require the MEF to focus on the following national categories of military responses:[5]

- o Insurgency/Counterinsurgency
- o Peacekeeping Operations
- o Peacetime Contingency Operations
- o Combating Terrorism

The Marine Corps has taken this a step further by expanding the range of LIC operations to include two basic types of operations which covers all four categories of national military responses addressed in the Presidential directive above. These operations are defined as follows:

- o Stability Operations where the use of force is a contingent, self-defense measure and includes such areas as humanitarian assistance, security assistance, and counternarcotic operations.[6]
- o Limited Objective Operations where the use of force is planned from the outset and includes such mission areas as strike operations, special warfare operations, and recovery operations.[7]

ASSUMPTIONS

Finally, in an effort to guide this study of the evolution of the MACCS and examine the future role that MACCS will play in support of MAGTF LIC operations in the twenty-first century, it becomes necessary to establish assumptions from which to validate

future concepts. The following list, although not inclusive, are key assumptions compiled from the MMP, MCLRP, MCCP, and the MACCS Operational Concept 2000:

o As established in Title 10, U.S. Code, there will be no change to the roles, missions, and requirements for three combat divisions/three air wings, tasked organized and employed as expeditionary, combined arms MAGTF's.

o The MAGTF will continue to be organized with a command element (CE), aviation combat element (ACE), ground combat element (GCE), and combat service support element (CSSE).

o U.S. Navy amphibious lift capability will be no less than that required to lift one MEF.

o The most likely employment of MAGTF's in the twenty-first century will be primarily as an expeditionary, "come as you are" force engaged in LIC or Mid-Intensity Conflict (MIC).

o The six functions of Marine Corps aviation (antiair warfare, offensive air support, assault support, electronic warfare, aerial reconnaissance, and control of aircraft, missiles, and RPV's) will be required by elements of the MAGTF.

o The mission, functions and roles, and doctrine governing the units, agencies, and elements which comprise the MACCS will remain basically the same into the first decade of the twenty-first century.

EVOLUTION OF MACCS

WORLD WAR II

Marine Corps aviation, although relatively young when compared to the rich heritage of the Corps, still enjoys a well

documented history when compared to the air command and control community. Not until the advent of World War II did the Marine Corps, then fully into the refinement of its amphibious mission, begin to contemplate the need of providing the necessary means to command, control, and coordinate its aviation assets.

The basis of what would much later evolve into today's MACCS took its early shape in the form of a command and control system which was initially afloat under the control of the Amphibious Task Force Commander. This early system was tasked with ensuring that air supremacy was maintained throughout the area of operations. It would provide centralized command and decentralized control both afloat and when the Amphibious Task Force Commander phased it ashore.[8]

The complexity of air defense command and control coupled with the arrival of radar in the closing campaigns of the Pacific made apparent the need for closer coordination of air-to-air and ground-to-air weaponry. Prior to the battle for Okinawa, coordination was satisfied with the formation of the Air Defense Command (ADC), established under the Tenth Army Tactical Air Force (TAF) and tasked to provide the amphibious landing force with the capability of assuming air defense command and control ashore. In addition to the command and control of air defense and close air support, the ADC was primarily concerned with the protection of the landing force from kamikaze attacks throughout the battle.[9]

The ADC would eventually consist of four Marine aircraft groups (fighters), three Army squadrons (fighters), and a Marine

air warning group consisting of five Marine air warning squadrons (AWS). The air warning group is the forerunner of our present day Marine Air Control Group (MACG). AWS-1 and AWS-7 are predecessors of modern-day Marine Air Control Squadrons (MACS)-1 and 7. These squadrons, through the direction of the ADC, were tasked with:

- o providing early warning of inbound enemy aircraft.
- o providing ground-controlled interceptions.
- o airspace management within their sectors.
- o assisting in air-sea rescue.
- o vectoring home lost aircraft.[10]

As the war continued through operations from the Gilbert Islands to Iwo Jima, another function of aviation--close air support (CAS) was beginning to take form. Like air defense command and control, it too would not reach its full potential until the Okinawan campaign. Air Liaison Parties (ALP), under the control of Landing Force Air Support Control Units (LFASCU), were assigned to ground combat units at the division, regiment, and battalion. The ALP's were responsible for advising supported commanders on the proper employment of CAS, as well as requesting and controlling assigned aircraft. The LFASCU's were responsible for processing and coordinating air support requests received from the ALP's with other supporting arms. The ALP's and LFASCU's would eventually form the basis of two of our present day air control agencies--the Tactical Air Control Party (TACP) and the Direct Air Support Center (DASC) respectively.[11]

Four additional developments of Marine Corps air command

and control have their beginnings during the Pacific and European theaters of the war:[12]

o First, the outgrowth of the Tactical Air Command Center (TACC) resulted from the landing force's need for a centralized aviation command element capable of integrating air defense and CAS. It was established during the battle for Okinawa as a mirror image of the CATF's agency, known by the same name--TACC, from a consolidation of TAF headquarters, ADC, and a LFASCU.

o Second, with the continued refinement of aviation for military purposes during the war, came a need to organize light, medium, and heavy surface-to-air weapons units to combat the air threat. These defense battalions, deployed throughout the Pacific under the control of the ADC, were the forerunners of our current Light Antiaircraft Missile Battalion (LAAM) and Low Altitude Area Defense Battalion (LAAD).

o Third, with the development of special high-precision radar during the closing days of the war, air traffic controllers throughout the Pacific were able to provide approach and departure guidance to aircraft during periods of reduced visibility. This ground controlled approach (GCA) radar, combined with surveillance radar, provided the successful beginnings of Marine air traffic control and the eventual establishment of our present-day Marine Air Traffic Control Squadrons (MATCS).

o Fourth, as the accuracy of position finding precision radar improved, ground-controlled bombing during periods of bad weather and reduced visibility was perfected in the European theater. Modified ground-based radars were used by controllers

to position aircraft over desired ground targets with required course and time-release information. This would later be adopted, prior to the Korean War, by the Marine Corps in the activation of the Marine Air Support Radar Teams (MASRT), known today as the ASRT.

Following World War II the air control community was organized under the doctrine of "centralized command and decentralized control," an idea that had been espoused in the final days of the war by the Marine Corps. The ADC, AWS's, and the air support units were integrated under the MACG concept which provided one MACG for Fleet Marine Forces Pacific (FMFPac) and one for Fleet Marine Forces Atlantic (FMFLant).

KOREAN WAR

As the Korean War unfolded, the Marine Corps would find its ground and aviation assets under the control of the Eight United States Army and Fifth United States Air Force respectively. This script would prove to be one of the most difficult parts the Marine Corps would be called upon to play. The Fifth Air Force would demand that Marine Corps aviation adhere to "centralized command and control" of air, a procedure that would later prove to be unresponsive to the ground units being supported and fuel the controversy of whether the Marine Corps should possess its own organic aviation assets.

The Fifth Air Force established procedures for all air operations to be centrally directed and controlled through the TACC of the Fifth Air Force/Eight Army Joint Operations Center

(JOC). Every air support request, regardless of priority, had to be channeled through the JOC control system which was riddled with delay and uncertainty.[13] Records kept by the U.S. Navy and First Marine Aircraft Wing reflected delays of up to 80 minutes with an average of 60-70 percent of the requested missions never being flown.[14]

MACG-2 deployed with three units to support the conflict in Korea: Marine Ground Control Intercept Squadrons (MGCIS)-1 and 3 (formerly AWS-1 and 12 respectively) and Marine Tactical Air Support Squadron (MTACS)-2. MTACS consisted of two sections: an air support section which deployed with its supported ground combat unit, and an air defense section normally in support of a MGCIS. Although dissatisfied with the constraints imposed by the JOC control system, the MACG was still able to provide remarkable close air support, ground controlled intercepts (GCI), and early warning assistance to the ground units they supported.[15] MACG-2 participated in operations in Pusan, Chosin Reservoir, Inchon-Seoul, the East Central and Western Front, and the armistice.[16]

The Korean War provided the newly established MACCS with its first real opportunity, following World War II, to investigate and explore a number of new and innovative air command and control ideas associated with doctrine, tactics, and new equipment. As the war continued, the following organizations and air control agencies emerged as equipment modifications and enhancements began to take shape in the newly established MACCS:

o During the Chosin Reservoir operation and subsequent withdrawal, when terrain became a limiting factor for adequate

ground control, a Tactical Air Direction Center (TADC) (forerunner of today's airborne Direct Air Support Center (DASC)) was established airborne to control and coordinate the employment of close air support operations. This agency averaged over 10 hours in the air daily as it controlled 211 missions, consisting of 869 aircraft during the six day operation.17

o During September 1951, the AN/MPQ-14, a ground-controlled bombing system (predecessor of today's ASRT) was developed by the Marine Corps and introduced into the Korean War. By the summer of 1952, as the system's reliability and accuracy improved, Fifth Air Force approved its operational employment in a close support role.18

o Marine air traffic control was organized into ground control approach units tasked with providing ground control approach and departure for the Marine Aircraft Groups (MAG) they supported.

o Marine antiaircraft artillery units, pioneers of today's LAAM and LAAD Battalions, were tasked with protecting key U.S. airbases.19

POST-KOREA/POST-VIETNAM PERIOD

During the twelve years between the Korean War and our entry into Vietnam, the MACCS would undergo a period of significant reorganization and technological development. First, and perhaps most important, the following reorganizations were completed:

o In February 1954, the Marine Ground Control Intercept

Squadrons were redesignated Marine Air Control Squadron (MACS). There were three MACS per Marine Aircraft Wing (MAW) each tasked with providing and manning a Counter Air Operations Center (CAOC) (forerunner of today's Tactical Air Operations Center (TAOC)).[20]

o In February 1954, the Marine Tactical Air Control Squadrons were redesignated Marine Air Support Squadrons (MASS). There would be one MASS per MAW. No longer would the MASS provide an air defense section, instead it would field a DASC and three ASRT's.[21]

o In 1956, the MACG was disbanded and its functions assumed by Marine Wing Headquarters Group (MWHG). In 1967 the MACG would be reformed and the MWHG would provide the personnel and communications-electronics equipment to establish a Headquarters and Headquarters Squadron (H&HS) and Marine Wing Communications Squadron (MWCS) under the MACG. Furthermore, the Ground Control Approach Units would become Marine Air Traffic Control Units (MATCU) and remain organic to the MAG's.[22]

o By the early 1960's, the surface-to-air weapons units, which had evolved from the antiaircraft artillery battalions of World War II, would leave the Force Troop ground structure and move into the MAW organization as a MACG unit. They would be redesignated as LAAM Battalions (armed with the HAWK missile system) with one battalion per MAW.

This interim period was also a time of new advances in technology for the MACCS, primarily in the areas listed below:

o In 1965 the Marine Tactical Data System (MTDS), a semi-

automated air control system, was introduced into the FMF.[23] This system, compatible with the Naval Tactical Data System (NTDS) and Naval Airborne Tactical Data System (ATDS), consisted of sensors, computers, display devices, and operators of the Navy and Marine Corps linked together to provide rapid dissemination of real-time, tactical and strategic information.

o During this interlude, the Marine Corps replaced the AN/MPQ-14 with the next generation ground-bombing system--the AN/TPQ-10. In addition to providing the capability of day and night, all-weather precision control of aircraft, it allowed for properly equipped aircraft to be controlled and ordnance released from the aircraft without the aid of the pilot.

Prior to our entry into Vietnam, the issue of tactical air command, control, and coordination authority in joint operations remained unresolved. The Marine Corps did not want to repeat the hard lessons of tactical air coordination experienced during the Korean War. In September 1963, a board of twelve officers from the Army, Navy, Marine Corps, and CINCPac staff, were tasked to investigate the full spectrum of tactical air support. Their two major findings are as follows:

o All services possessed aircraft that were mission essential.

o The Joint Force Commander (JFC) could designate one of his component commanders as coordinating authority for tactical air operations. This coordinating authority, as a direct representative of the JFC, could consult between services but could not direct subordinate commanders. Direction authority

still resided with the JFC.

Although no formal agreement was ever reached, this forum did provide an opportunity to allow arbitration among services in disagreement. But more important, the forum was the turning point in favor of the Marine Corps maintaining operational control of its own organic aviation assets[24], an issue that would continue to plague the Marine Corps until a JCS resolution in 1986.

VIETNAM

Units of the MACCS were depolyed to Vietnam in the spring of 1965 and would remain in country as key players in support of forces until 1971. The following chronology of events traces the introduction, employment, doctrinal changes, and technological developments and improvements of MACCS agencies throughout the Vietnam War:

o February 1965, 1st LAAM Battalion arrives in country and is employed at Da Nang. 2d LAAM Battalion is employed at Chu Lai in September. Tasked with providing air defense control and coordination, the missile batteries and assault fire units were deployed along vital areas of suspected enemy air employment. In order to interface with the the Air Force's Control and Reporting Center (CRC) at Monkey Mountain, both battalions establish their own Antiaircraft Operations Center (AAOC). Before the war concludes, both battalions are established as MACG units.[25]

o April 1965, MASS-2 and MASS-3 arrive and are immediately tasked to provide DASC's to support decentralized control of di-

rect air support operations to deployed Marine divisions in such places as: Da Nang, Dong Ha, Khe Sanh, Phu Bai, and Fire Base Vandergrift. The DASC's are located with their respective ground force Fire Support Coordination Centers (FSSC) to facilitate coordination of supporting arms.[26] In addition, the ASRT's, organic to the MASS's, will establish an impressive record of precision ground-controlled bombing. For example, during 1966-1971, ASRT's from MASS-3 alone will control more than 38,010 AN/TPQ-10 missions, directing more than 121,000 tons of ordnance on 56,753 targets.[27] Before the war ends, MASS's will have supported virtually every major Marine combat operation.

o May 1965, MACS-9, equipped with an early warning radar, deploys a manual TAOC (now renamed from CAOC) to Phu Bai to provide decentralized control of air defense. Three months later MACS-9 will be relieved by MACS-7. In June 1967, MACS-4 will replace MACS-7 and with their arrival provide the first modern, semi-automated, computer-oriented TAOC. Equipped with the Tactical Data Communications Central (TDCC), the TAOC now had the capability to simultaneously track 250 aircraft tracks and control 25 intercepts. In late August 1969, the interface of air command and control systems of the Marine Corps, Army, and Air Force was completed setting the stage for future joint operations.[28] Fully integrated air defense had finally arrived.

o The TACC, operating as a Tactical Air Direction Center (TADC) subordinate to the Air Force's CRC, was established in June 1965 at Da Nang. Throughout its time in country, this Marine TADC functioned as the senior MACCS agency tasked with the

supervision, direction, control, and coordination of all tactical air operations in its assigned area.

o Although still not a part of the MACG at the time, but tied in with the TAOC's for aircraft hand-off procedures, the MATCU's were deployed throughout Vietnam. Still organic to the fixed wing and helo MAG's, they would continue to provide approach/departure control and tower facilities for the duration of the conflict.

POST-VIETNAM TO THE PRESENT

During the twenty years following Vietnam, the MACCS has undergone major organizational changes, innovative equipment enhancements and developments in technology, and significant doctrinal growth. In an effort to bring the reader into the 1990's, lets first review the two major organizational changes the MACCS has undergone:

o First, in 1975, the MATCU's were redesignated as Marine Air Traffic Control Squadrons (MATCS) and become a part of the MACG. They provide the capability of continuous all-weather air traffic control (ATC) at expeditionary airfields and limited ATC services at remote landing sites in support of the MAGTF.

o Second, in 1986, the Forward Area Air Defense (FAAD) Battery, equipped with REDEYE missiles, would be reorganized into LAAD Battalions and established under the MACG. They would provide short-range, low-altitude air defense protection to the MAGTF.

Next, we will review (by unit) the major introduction of new MACCS equipment and technology:

o LAAD: STINGER missile system, is a man-portable, shoulder-fired, infrared radiation (IR) homing (heat seeking) guided-missile system.

--Digital Communications Terminal (DCT), AN/PSC-2, delivered to the FMF in 1988, provides the LAAD STINGER teams the capability to transmit, edit, display, and review preformatted free text messages and graphics utilizing burst transmissions.

o MACS: Tactical Air Operations Module (TAOM), AN/TYQ-23, is a transportable, modular, softfware-intensive, automated system, capable of controlling and coordinating the employment of air defense weapons in support of any size MAGTF. Up to four TAOM's will be used at the TAOC. Replacement of the existing AN/TYQ-2 and 3A equipment will take place during FY-92.

--AN/TPS-59, fielded in August 1985, is a long-range, three-dimensional air surveillance radar employed as the primary sensor for the TAOC. It provides capabilities for surveillance, ground controlled intercept missions, and air traffic control out to ranges of 300 nautical miles and an altitude of 100,000 feet. It replaces the AN/TPS-22A.

o LAAM: Fielding of the new, improved HAWK missile system. Employing a semiactive homing system, it defends assigned areas of operations and vital zones against high-speed, low-to-medium altitude hostile aircraft and missiles. During FY 92-97 the HAWK Mobility Enhancement Program will be intitiated to enhance the missile system's employment flexibility and reduce as-

sociated lift requirements. This program is integral to the Marine Corps medium altitude air defense capability.

o H&HS: Advanced Tactical Air Command and Control Central (ATACC) is scheduled to be fielded during FY-92. It will replace the existing TACC and its associated suite of equipment (AN/TYQ-1 and 3A). It will consist of four International Standards Organization (ISO) shelters with work stations which will display the air battle graphically using tactical data link (TADIL) inputs. This new equipment will allow the tactical air commander (TAC) to conduct near real time air defense of the MAGTF while simultaneously conducting offensive air support (OAS), assault support, air reconnaissance, electronic warfare (EW), and control of subordinate control agencies and surface-to-air missiles. Additionally, the ATACC will have the ability to establish TADIL A, B, and NATO line-1 links with automatic exchange of texts using either Joint Interoperability of Tactical Command and Control Systems (JINTACCS) or Marine Tactical System (MTS).

--OE-334/TRC is a transportable, ground-air-ground communications shelter built to support the TACC, ATACC, and IDASC. It consists of a shelter with provisions for 6-UHF, 4-HF, 3-VHF/FM, and 2-UHF/VHF-AM transceivers and remoting capability up to four miles.

o MATCS: Marine Air Traffic Control and Landing System (MATCALS) entered the FMF in 1986. It provides a semiautomated terminal air traffic control capability for control of high volume traffic with minimum weather and visibility limitations. Although not completely fielded to date, it consists of three sub-

systems: (1) an air traffic control subsystem (ATCS), AN/TSQ-107 (and follow-on system, AN/TPS-73), which detects and identifies aircraft at ranges up to 250 miles; (2) an all-weather landing system (ALS), AN/TPN-22, which is a navigational aid for the controlled approach and landing of aircraft; and (3) a control and communications subsystem (CCS), AN/TSQ-131, which provides data processing, user-interface display functions, and communictions.

--Marine Remote Area Approach and Landing System (MRAALS), fielded in 1980, consists of two subsystems: (1) a ground transmitter, AN/TPN-30, which provides the pilot with the information required to locate remote landing zones and make approaches in instrument meteorological conditions; and (2) the airborne multi-mode receiver (MMR), AN/ARN-138, that displays the information.

o MASS: Improved Direct Air Support Center (IDASC), AN/TSQ-155, was fielded in 1987 to replace the AN/TSQ-122. It is a transportable, ground-air-ground, ISO shelter which provides the capability for enhanced systems reliability, availability, maintainability, and mobility required to control and coordinate direct air support for sustained operations in support of MEF and MEB contingencies.

--OE-334/TRC is the communications shelter which supports the IDASC (see ATACC).

--AN/TPB-1D, fielded in 1984 as a replacement for the AN/TPQ-10, is a ground based, fire control radar which gives the ASRT the capability to control aircraft in suport of visual

CAS or the release of ordnance in an all-weather, day or night MAGTF operations.

--DCT, AN/PSC-2, provides digital burst transmission capability for the IDASC and ASRT (See LAAD).

As the MACCS enters the 1990's, a wide range of FMF manuals and publications are now available that address the organization and operational employment of the MACCS in support of the MAGTF. Operational Handbooks (OH) specializing in antiair warfare, employment of LAAD, and control of aircraft and missiles now provide the basis for the doctrine, tactics, and techniques so essential in the effective integration of all elements of the MACCS. In addition, these FMFM's and OH's outline such areas as relationships with land-based surface-to-air weapons systems; employment of aviation in support of amphibious operations; and air command and control systems of other services.

But perhaps the most significant doctrinal growth to emerge in the area of air command and control of MAGTF aviation was the "1986 Omnibus Agreement." This agreement, approved on 4 March 1986 by the JCS, approved a new policy for command and control of Marine Corps aviation during sustained operations ashore. Key portions of that text taken from White Letter 4-86, dated 18 March 1986, follows:

> The Marine air-ground task force (MAGTF) commander will retain operational control of his organic air assets. The primary mission of the MAGTF air combat element is the support of the MAGTF ground element. During joint operations, the MAGTF air assets will normally be in support of the MAGTF mission. The MAGTF commander will make sorties available to the joint force commander, for tasking through his air component commander, for air defense, long-range interdiction, and long-range reconnaissance. Sorties in excess of MAGTF direct

> support requirements will be provided to the joint force commander for tasking through the air component commander of the joint force, or the joint force as a whole.
>
> 1986 Omnibus Agreement

Concurrently, the JCS also approved JCS Publication 26, Joint Doctrine for Theater Counterair Operations. This publication is a "comprehensive air operations doctrine" that outlines the contributions to be made by all Service components to the counterair effort. JCS Publication 26 and the Omnibus agreement "represent an evolution toward common ground between four-Services. Despite different perspectives and philosophies on joint warfighting we have moved toward a common goal. The common goal is increased joint warfighting effectiveness--a win-win situation."29

In promulgating these agreements in White Letter 4-86 the Commandant of the Marine Corps, then General P.X. Kelley, fully endorsed their contents, spirit, and intent and directed subordinates to "give the Joint Force Commanders our enthusiastic, professional support in ongoing efforts to enhance all aspects of warfighting." These agreements provided the foundation that established the Marine Corps right to operationally control its own aviation assets and assigned airspace, reinforcing the vital role that the MACCS would continue to play in future support of MAGTF operations.

OVERVIEW OF TODAY'S MACCS

As we approach the twenty-first century, with the range,

speed, types, and diversity of aircraft necessary to support an amphibious operation, it is imperative that MAGTF air operations are conducted under a system which provides for centralized command and supervision at the highest level in order to allow for maximum effective use of available aviation resources. The concept of subdividing an extensive, operational area into small zones of action and exercising aviation control through several subordinate commanders, as in the case of ground operations, does not provide for the requisite immediate inflight response to aviation support requests. For example, the delay imposed by issuing, through a group commander, a divert order to aircraft of the group already airborne on a prebriefed mission would be patently unacceptable. Thus, coordination and control over a relatively broad area by a single commander is essential to tactical air operations. To meet this requirement, the MAGTF commander exercises air command and control through his TAC by providing him with the MACCS, a centralized control system. The concept of operations for the MACCS provides for centralized coordination and supervision of tactical air operations at the highest level of the MAGTF but, at the same time, facilitates decentralization of actual control authority to subordinate control agencies.30 Likewise, the MACCS provides the TAC with the capability to control airspace within an assigned sector, to coordinate and interoperate with similar systems in joint and combined operations, and with the means to command and control the six functions of Marine Corps aviation.

MACCS FUNCTIONS AND RESPONSIBILITIES

Before moving on to examine the MACCS operational employment and eventually its projected role in support of MAGTF LIC operations in the twenty-first century, let's first review briefly the key functions and responsibilities that today's MACCS agencies perform for the MAGTF commander:31

o TACC. The senior air command and control agency of the MACCS which provides the facilities for the TAC to supervise and coordinate all MAGTF tactical air operations. Command of all MAGTF aviation assets is centralized at the TACC. Control of aircraft and ground based surface-to-air weapons systems is decentralized to the subordinate MACCS agencies. The TACC may be referred to as a TADC prior to the CATF transferring command and control of tactical air operations in the amphibious objective area to the CLF. With the transfer of responsibility, the MAGTF TADC becomes a TACC while CATF's TACC (afloat) becomes the TADC.

o TAOC. The agency within the MACCS, subordinate to the TACC/TADC, which is responsible for the MAGTF air defense functions. The TAOC detects, identifies, and controls the intercept of hostile aircraft and missiles; provides airspace management and navigational assistance to friendly aircraft; and provides target assignment for weapons systems. The TAOC may function as the alternate TACC/TADC when directed.

o DASC. The agency within the MACCS, subordinate to the TACC/TADC, which is responsible for the MAGTF direct air support (DAS) functions. The DASC processes direct air support requests, coordinates aircraft employment with other supporting arms, and

controls aircraft within the procedures of airspace control. To accomplish this, the DASC normally collocates with the senior GCE fire support coordination center (FSSC).

o ASRT. A terminal control agency subordinate to the DASC which provides day, night, all-weather radar tracking, positioning, and terminal control of aircraft operating in support of MAGTF air operations.

o Air Traffic Control Detachments (ATCD). The ATCD provides approach control, ground-controlled approach (GCA), tower control, and navigation aids (NAVAID's) at designated expeditionary airfields (EAF) or host airfields in all weather conditions where existing facilities are non-existent or inadequate. Furthermore, ATCD's can provide limited services at remote landing sites.

Surface-to-air weapons available to the MAGTF consist of HAWK and STINGER missiles which are provided by the LAAM and LAAD Battalions respectively. Command of air defense resources in the MAGTF is executed by the TAC in the TACC and authority for the management of the integrated air defense assets is delegated to the TAOC for execution of the air defense plan. These air defense systems and their associated units are discussed below:

o HAWK. Surface-to-air missile system maintained by the LAAM Battalion provides the MAGTF surface-to-air missile (SAM) defense against low-to-medium altitude hostile aircraft for designated installations and vital zones or assigned areas of operations. Control and coordination of LAAM batteries will be accomplished through the TAOC. The Battery Control Post (BCP),

subordinate to the TAOC, provides operational control of the LAAM firing units via voice and data link communications.

o STINGER. Man-portable missile system maintained by the LAAD Battalion provides close-in, low-altitude, air defense protection for elements of the MAGTF in forward combat areas, in defense of vital areas, and units engaged in independent operations.

Although not organic to the MACCS, it is important to briefly mention another aspect of air control--the airborne terminal air control agencies. In the execution of tactical air support operations, air control provided through a ground agency is frequently not available or feasible because of terrain or observation restrictions, or not readily adaptable to a rapidly changing air scenario. At times like these, restrictions for the most part are overcome by the use of airborne controllers and coordinators. The MACCS has the ability to meet these requirements by using the following airborne agencies:

- o Tactical Air Coordinator (Airborne) (TAC(A))
- o Forward Air Controller (Airborne) (FAC(A))
- o Helicopter Coordinator (Airborne) (HC(A))

Positioned in tactical aircraft in close proximity to the area of concern, these coordinators observe air and ground activity and provide coordination from a relatively detached vantage point. Equipped with the necessary VHF/UHF/HF communications, these airborne coordinators maintain contact with ground combat units or air control agencies and supporting aircraft serving as a focal point between the two. They have the

capability to operate in support of ground combat units or confine their support simply to the coordination of aircraft while keeping the MACCS current on the requirement and utilization of .employed MAGTF aviation assets. All three airborne control agencies offer functional ground control agencies, such as the DASC or TACC/TADC, an extension of the means to significantly contribute to the flexibility and effectiveness of the MACCS.

MACCS ELEMENTS

Although the MACCS itself is functional in organization, there are no established tables of organization or equipment for its functional agencies (Figure 1).

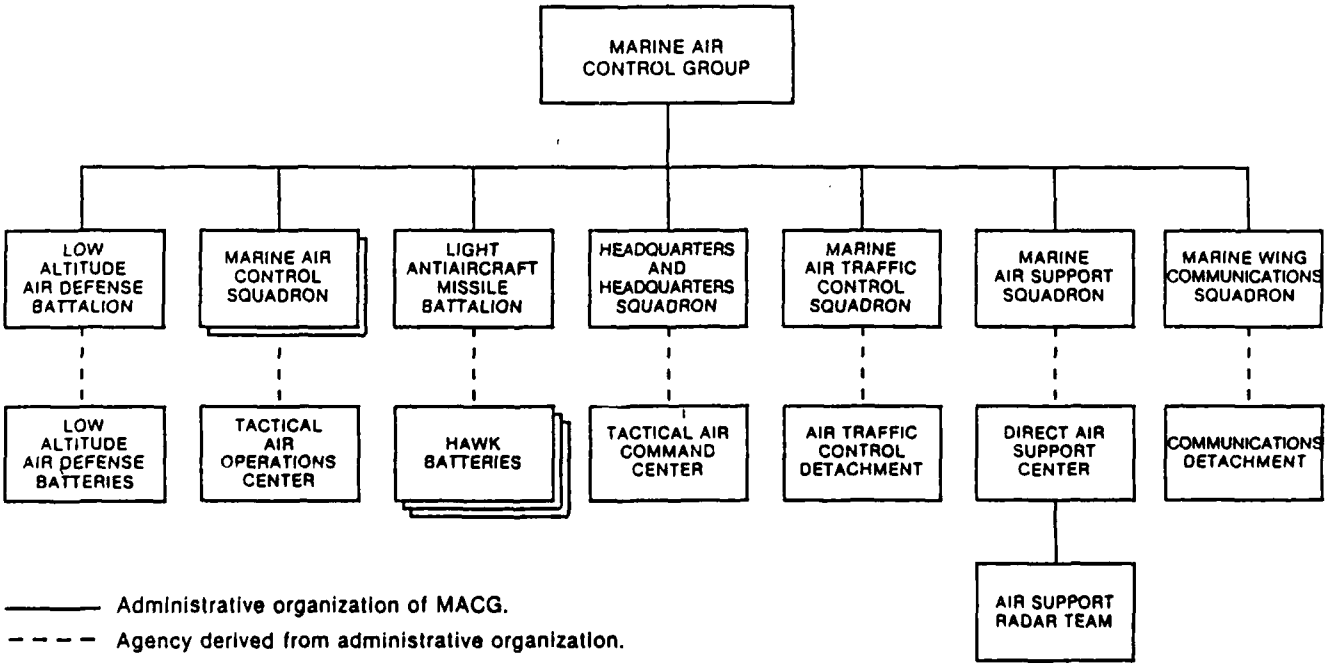

Figure 1. Relation of MACCS to MACG

The personnel and equipment required to establish the major air direction and control agencies of today's MACCS are contained in the tables for the appropriate administrative organizations found in the MACG. The MACG's primary mission is to provide, operate, and maintain the MACCS.

The MACCS of the 1990's is composed of a variety of units and agencies designed to rapidly process, evaluate, and disseminate on a real-time basis, essential elements of information which commanders must utilize to make sound tactical decisions. The information is processed by high speed general and special purpose computers and disseminated via digital data, teletype, and voice communication links.

MACCS CONCEPT OF EMPLOYMENT

Today's MACCS is tasked organized to support MAGTF operations. For purposes of this study we will continue to examine the MACCS role in support of the MEF because the MEF normally involves all of the MACCS air control agencies. Within the context of MEF operations, it is imperative that the MACCS fundamental concept of employment remain "centralized command and coordination, and decentralized control and execution;" which not only satisfies required functions of the MACCS agencies but accomplishes taskings without encumbering the MAGTF's ability to maneuver, fulfill its mission, and win on the battlefield. The balance of this paragraph will furnish the reader with some basic understanding of the force structure required from the MACCS to meet MEF requirements. This will be done by reviewing Control of

Aircraft and Missiles (OH 5-8) and providing one final look at MACCS agencies and unit assets associated with sustaining the MEF MAGTF.

o TACC is the MEF's senior MACCS agency. It will normally be an automated facility exchanging tactical digital information in the joint and combined arena through data link interface and providing communications with higher and adjacent headquarters, subordinate MAG's, and other MACCS agencies.

o One or two TAOC's are employed per MEF depending on the size of the operating area, radar coverage requirements and capabilities, and the level of operations. Depending on terrain and situation, remote radar and early warning control (EW/C) sites may be required to supplement TAOC long-range radar coverage.

o As the principal air control agency responsible for the conduct of direct air support operations for the MEF, a DASC facility of substantial size and capability will be required. When practicable, it will collocate with the senior FSCC responsible for coordination of all MAGTF supporting arms and contain an echelon capability to maintain continuous control and communication during periods of displacement.

o A LAAM Battalion, consisting of two HAWK missile batteries, will normally be required to provide ground-based air defense for the MEF in locations best suited to support the MAGTF's air defense priorities. Control and coordination of LAAM assets will be accomplished through the TAOC.

o The entire LAAD Battalion will normally support MEF operations. Mission support roles for LAAD STINGER assets are

decided by the MEF commander. The preferred method of employment is general support; however, the MEF commander may determine requirements for direct support of certain ground combat units, vital areas, or other activities. Normally, control of LAAD will be decentralized to the fullest extent possible.

o The MATCS can provide all-weather ATC service at up to four EAF's along with limited support at forward area landing sites for the MEF. Surveillance radar assets of the MATCS will also be integrated into the air defense system as appropriate.

o The entire MWCS will be required in support of MEF operations. They will be tasked to install, operate, and maintain tactical communications equipment and facilities for the ACE headquarters and MACCS requirements.

Hopefully, by tracing the evolution of the MACCS units, airborne and ground-based air command and control agencies, communications, sensors, and weapons sytems, the reader has developed a better appreciation of MACCS operational concepts, characteristics, and capababilities and how they may be better employed to win on battlefields of the future. In addition, this study attempts to arm the reader with the knowledge and ability to recognize that "the MACCS is an organized assembly of resources and procedures, united through integration, interaction and interdependence, and regulated by rules of engagement, protocols, and the commander's direction and guidance."[32] It is through this process that the MACCS gains its strength as the linking-pin between aviation and ground combat elements.

Therefore, as we enter the twenty-first century, it be-

comes imperative that the MAGTF commander become proficient in all aspects of the MACCS in order to maximize its effectiveness. He must recognize both the tactical capabilities and limitations of the system if he is to exploit real-time options into battlefield opportunities without prohibitive interference from enemy air, command and control, and missile systems.

FUTURE ROLE OF THE MACCS

Battlefield Environment

The most likely armed conflicts from now through the first decade of the twenty-first century will be low intensity, unconventional warfare. With the proliferation and export of sophisticated weapons of great lethality throughout the world, there will be many nations which can mount a significant air, sea, land, and--to a lesser extent--military space threat to the U.S. interests. In addition, we will no longer enjoy almost absolute freedom of action within U.S. territory. Ports of embarkation, major transportation hubs, key industries, and political and military leaders could easily be the targets of terrorists, saboteurs, enemy agents, and infiltrators. Such actions are well within the capabilities of almost any nation today and will be even more so in the next two decades.33

MAGTF operations of tomorrow will be highly expeditionary in nature, characterized by amphibious assaults from over the horizon (OTH) as well as from near shore and in all climates, all weather, day and night, and in all types of terrain. MAGTF landings may occur in areas which are lightly defended in order

to achieve tactical surprise and minimize losses. Forces will be landed by both surface and air, proceeding rapidly inland to link up with the preponderance of forces projected by air. The MAGTF will be characterized by strong emphasis on the offensive, balanced and complementary in the use of firepower and maneuver, and highly mobile. The Navy and Marine Corps tactical air control systems will continue to integrate and mirror one another to facilitate phasing control ashore and providing redundancy in the event of battle damage or catastrophic failure. As sufficient combat power is built up ashore, reconnaissance and screening forces will be employed. Once ashore, the main body will continue the assault overland, by air and ground, to accomplish the MAGTF mission. During sustained operations ashore, the MAGTF will be provided a sector of responsibility. The MACCS will employ automated systems with manual redundancy to interoperate and coordinate air control operations with adjacent, higher, and lower echelons from both airborne and ground based command and control agencies and LAAM/LAAD weapons systems. Friendly and enemy forces may be dispersed over a large area operating from remote, well concealed sites and only concentrating en mass for the main effort. This dispersal will be possible and necessary in some cases due to improvements to our own and the "threat's" capabilities.[34]

On the battlefield of the future we might expect to encounter a new generation of advanced rotary and fixed wing aircraft, which will have the capability to:

- operate and deliver ordnance accurately, in day/night,

all-weather conditions and at greater ranges.

- o operate from remote/unimproved sites.
- o fly faster, lower, with tighter turning radius.
- o carry a greater variety and heavier loads to include "fire and forget" and "stand-off" precise munitions.
- o maintain low radar cross section while equipped with passive and active ECM.35

On the fluid, fast paced battlefield of tommorrow we will more than likey encounter a new generation of advanced missile/ munitions systems to include high power microwave (HPM), directed energy, and enhanced kinetic energy. These systems will have greater mobility, range, and lethality while proving more difficult for the MAGTF to detect, track, and destroy.

Regardless of which forces achieve the technological break-throughs mentioned above, the present and proposed warfighting capabilities of the MAGTF will be adversely effected. "Threat" advancements, without commensurate U.S. countermeasures could negate the primary offensive firepower of the MAGTF. For example, "threat" deployment of HPM systems, both ground and airborne applications, could negate effective employment of all of the electronic-intensive aircraft, air-to-surface weaponry, air defense capabilities, and the entire MACCS systems of the MAGTF. Such break-throughs could require the Marine Corps to restructure and reequip the MAGTF, revise doctrine, and/or reexamine amphibious warfare feasibility. The potential impact upon the MACCS which is presently (and proposed to be) equipped with communications and sensors entirely oriented towards con-

trolling conventional aircraft, remotely piloted vehicles (RPV), and missiles would be significant. This becomes increasingly apparent should these advanced technologies achieve true fruition and reach the battlefield of tomorrow.

FUTURE MACCS CHARACTERISTICS

Less militarily powerful third country nations and factions will continue to emerge using unconventional warfare tactics to a greater degree. The importance of such LIC roles as infiltrations, raids, ambushes, and attacking high value targets in rear areas will increase significantly for the MAGTF employed under forcible entry conditions. Also to increase is the likelihood of the MACCS encountering a "high-tech threat."

There are a few preventive measures that must be executed now to minimize the negative aspects associated with the high-tech environment and maximize the positive factors that the future MAGTF MACCS will require to counter the "threat" and ensure its survivalability on the battlefield. MACCS Concept 2000 identifies these measures as command, control, communications, computers, intelligence, and interoperability (C^4I^2) characteristics and recommends that the MACCS address them as follows:[36]

o Deployable. Lift footprint (cube/weight) needs to be significantly reduced if it is to be truely expeditionary.

o Mobile. C^4I^2 systems must be man/vehicular portable, self-contained, and capable of operation from any of the ground or air mobility means common to the MAGTF in the 2000-

2010 period.

o Survivable. Capable of surviving induced/natural battlefield effects and have same degree of protection as the forces it accompanies.

o Sustainable. Must possess right mix of organic/external support systems to sustain continuous operations for short/long durations.

o Flexible. Ability to provide various types/amounts of capabilities as the situation dictates. This implies the capability to operate in degraded mode when components fail or are damaged.

o Interoperable. Capable of integrating in joint, combined, NATO C^4I^2 and air defense environment.

o Lethal. SAM/offensive air weapons controlled by MACCS must be able to defeat threat systems employed against the MAGTF.

o Correct Numbers/Mix. MACCS must possess enough C^4I^2 systems and weapons to accomplish required functions.

Whatever titles we elect to give these initiatives is unimportant as long as we recognize that they are directly translatable into MAGTF warfighting requirements (improvements) relevant to overcoming future limitations of the MACCS. Furthermore, the principal of centralized command and decentralized control, especially if the MACCS retains the capability to conduct effective autonomous and manual operations, will continue to be just as valid in the twenty-first century.

PROPOSED CAPABILITIES/TECHNOLOGIES

We have examined some of the prudent and realistic baseline characteristics that the MACCS must adopt regarding required general capabilities if it is to survive and execute its mission in support of MAGTF operations in the LIC environment of the future. At this point, most would agree that the operational concepts, i.e. mission, functions, roles, conditions, and required capabilities, that govern the MACCS today will, for the most part, remain in tact in the years to come.

The two most significant concerns apparent in the air command and control community which facilitates projected MACCS support for MAGTF operations into the first decade of the twenty-first century are primarily in the areas of equipment acquistion and procurement. The following projected specific requirements reflect concern:

o Equipment, i.e. communications-electronics, engineer, and motor transport that stresses commonality, mobility, survivability, modular components, redundant subsystems, reliable power sources, and durability of parts.

o C^4I^2 state-of-the-art equipment that is automated, compact, reliable, responsive, nodeless, jam-resistant, and compatable throughout MAGTF and joint/allied environment.

A number of general theories exist as to how the MACCS' capability could be enhanced to allow for more efficient utilization and employment in future operations that cross the spectrum of conflict. These ideas, stated in the broadest of terms, provide the basis for examination of operational concepts. If

soundly developed, they could result in the developlment of new doctrine, tactics, techniques, procedures, training, structure, organization, systems acquisition, and weapons/equipment procurement. Rather than develop these ideas, the following list is provided as an overview of current thinking being generated within the MACCS community as the shift in focus narrows for survivable and realistic support of MAGTF operations on the world's battlefields in the upcoming century:

o Continued development of over-the-horizon communication capability especially in areas of HF/UHF requirements.

o Continued development of single channel local area networking and associated tactical hardware/software and communications security (COMSEC) devices.

o Continued development of UAV/RPV capabilities, missions, and control issues, particularly in areas of communications retransmission and real-time targeting, deconfliction, and intelligence exchange.

o Continued emphasis to address MAGTF/MACCS requirement to possess in-house satellite communications capability.

o Continued requirements for more fully integrated offensive/defensive, joint/combined operational training.

o Continued development of radar equipment and technology. Further investigation of electronic vice mechanical scan rates, radar decoys, and incorporate time phased radar emitting plans with overall concentration on ECCM fixes and enhancements. Continue to explore gains received through introduction of airborne radar platforms and standardization of sensors within the MACCS.

o Continued refinement of EMCON procedures in high threat environment.

o Continued development and enhancement of low altitude surveillance and common sensors/display capability netted to pass real-time data to each MACCS agency with a need-to-know requirement, i.e. TACC, TAOC, HAWK and STINGER units.

o Continued enhancements of radar systems software and hardware technology to provide the ability to turn on/off at will without interrupting data exchange between agencies.

o Continued development and procurement of STINGER enhancements, i.e. pedestal mounted, night sights, and the air defense variant of the light armored vehicle.

o Continued refinement/development of air traffic control landing systems to include such needs as microwave, data link, global positionning system (GPS), expanding sensor remoting and ECCM capabilities, and equipment to support remote area landing sites.

o Investigate existing MACCS to examine baseline packaging of agencies, standardization of shelters, and possibilites of combining functions/facilities in an effort to streamline MAGTF support, i.e. combining the DASC/FSCC or perhaps coupling an EW/C with a HAWK base fire unit.

o Investigate advantages/disadvantages of future MACCS air control agencies moving away from procedural control towards more automation utilizing digital data links.

o Investigate the reorganization of the existing LAAD/LAAM units into one integrated air defense SAM unit which would in-

crease the number of STINGER teams while maintaining two HAWK firing batteries in support of the MAGTF (MEF).

CONCLUSIONS

It is a time of significant change in the world particularly in view of the democratic reforms and reductions in Soviet forces taking place in Eastern Europe. For the first time strengths and capabilities of the Soviet Union have taken on the "illusion" of decline. As a result of this new threat assessment is domestic pressures in the U.S. to cut defense spending. But what about the threats that still face the U.S. on other fronts? What about the growing number of countries that possess ballistic missiles capable of launching nuclear, chemical, or biological weapons? What about the continued presence of terrorism and narcotics trafficking that the U.S. must continue to contend with despite the dramatic changes that are unfolding in Eastern Europe and the Soviet Union?

A "threat" still remains and because of that we must continue to press forward in the advancement of technology by a continuation of research and development funding. Billions of dollars worth of present and future MAGTF C^3I^2 systems, aircraft, surface-to-air weapons, could be made virtually obsolescent within a short period of time should the technology of threat forces be tactically deployed ahead of our own. Thus, it becomes imperative that the MACCS community not lose sight of the focus of effort for the future as it plans to remain a formidable asset for the MAGTF.

C^4I^2 systems will continue to have a direct influence on the success or failure of future combat operations. In the equation of war, forces with the most effective C^4I^2 and equally proficient commanders will have a distinct advantage. The projected C^4I^2 that will be available to the U.S. military in the twenty-first century will allow a wide area of battlefield management; i.e., powerful centralized battlefield management on a global scale that still provides the commander, both now and in the future, with the C^4I^2 system of centralized command and decentralized control. At the same time, existing and projected technology will continue to provide for a distributed communications, surveillance, and battle management systems. The Marine Corps will have at its disposal national, joint, and (possibly) combined assets to assist the MAGTF commander of the future in planning combat operations and in directing, coordinating, and controlling forces in the accomplishment of his mission.

In conclusion, members of the air-ground team must continue to take a hard and serious look at ourselves today and into the future if we are to optimize our warfighting ability and preserve what makes the Marine Corps unique. Not only does the burden of responsibility lie with our future MAGTF commanders, but also with the air control community. Our commanders must continue to fine tune their knowledge of the MACCS and its employment as an integral part of the MAGTF and we as air controllers to provide innovative thinking and solutions to

"changes in doctrine, organization, structure, training, and acquistions of new equipment/systems" to support tomorrow's fluid battlefield requirements.

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